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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/779,876	02/18/2004	Thomas H. Windhorn	071469-0307904	9493

909 7590 09/12/2006

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EXAMINER	
GLENN, KIMBERLY E	

ART UNIT	PAPER NUMBER
2817	

DATE MAILED: 09/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/779,876	WINDHORN, THOMAS H.	
	Examiner	Art Unit	
	Kimberly E. Glenn	2817	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 9/14/05.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-72 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-28,30-41,43,45-58,61-68,71 and 72 is/are rejected.

7)☒ Claim(s) 29,42,44,59,60,69 and 70 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 9-21, 24, 25 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092. (Of record)

The primary reference, Brounley discloses in figures 1 and 2, a plasma processing system comprising of a reaction chamber 114 and RF generator 12 and a tuner 10 comprising a matching network 18. The matching networks comprising of fixed capacitors (C' C") and variable inductor L". The matching network has a Pi circuit topology. Inherently, the inductor and capacitor components of the impedance matching network will act as a filter.

Thus, Brounley is shown to teach all the limitation of the claims with the exception of the variable inductor including a magnetic core, a helical coil and actuator configured to physically translates the magnetic core through the helical coil, the matching network having a Pi circuit topology, the magnetic core being the only movable element and the coil being stationary.

Thornton et al discloses in figure 2a-2d,a schematic representation of a variable inductor comprising of a cylindrical coil 113, a movable contactor 115, and a magnetic

core suitable to travel axially within the interior of coil. The magnetic core is composed of a ferrous material. Figure 3 shows a suitable structure for implementing the variable inductor. The variable inductor is capable of operating in the radio frequency range. (Column 3; line 3 through column 4 line 8)

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the variable inductor of Brounley with the variable inductor as taught by Thornton et al. The motivation for this modification would have been to provide variable inductor capable of operating in the radio frequency range.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the matching network configured to deliver maximum radio frequency power of 500W, 1500W, 2500W, 3500W, 4500W and 5000W since it has been held that the discovering the optimum values of a result effective variable involves only routine skill in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the magnetic core of the variable inductors have a Curie temperature greater than 150 C, 200 C, 250 C, 300 C, 350 C, 400 C since the magnetic core material having a greater magnetic permeability has a lower Curie temperature, therefore it has been held that the discovering the optimum values of a result effective variable involves only routine skill in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the temperature factor of permeability to be within the

range of $-1 X10^{-6}$ to $40 X 10^{-6}$ since it has been held that the discovering the optimum range involves only routine skill in the art.

Claims 2 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Wickramanayaka et al US Patent 6,462,482.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the plasma processing system being a magnetically enhanced capacitively coupled plasma reactor.

Wickramanayaka et al (6,462,482) disclose a magnetically enhanced capacitively-coupled plasma processing system for sputter deposition applications with higher ion concentration, higher ion flux uniformity on the substrate surface and without the re-deposition of sputtered materials back on the target plate. (Column 3 line 14-19)

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the general plasma processing system with the magnetically enhanced capacitively coupled plasma reactor as taught by Wickramanayaka et al. The motivation for this modification would have been to provide the plasma process with higher ion concentration and higher ion flux on the substrate surface.

Claims 3, 4, 39 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Salimian et al US Patent 5,656,123.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the plasma processing system being a two frequency capacitively coupled plasma reactor.

Salimian et al disclose a dual frequency capacitively coupled triode plasma reactor capable of providing a high power to the plasma with a relatively low positive potential so that a relatively ion dense (on the order of 10.sup.11 ions/cc) plasma is formed while little or no etching of the top electrode or other surfaces of the interior of the reactor in contact with or in close proximity to the plasma occurs. (Column 4 line 37-44)

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the general plasma processing system with the two frequency capacitively coupled plasma reactor as taught by Salimian et al. The motivation for this modification would have been to provide the plasma process capable of providing a high power to the plasma with a relatively low positive potential so that a relatively ion dense (on the order of 10.sup.11 ions/cc) plasma is formed while little or no etching of the top electrode or other surfaces of the interior of the reactor in contact with or in close proximity to the plasma occurs.

Claims 5 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Singh US Patent 5,309,063.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the plasma processing system being an inductively coupled plasma reactor.

Singh (5309063) disclose an inductively coupled plasma production apparatus. The coil 12 of the invention has a greater inductive component than the flat coil and therefore generates a greater ion density.

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the general plasma processing system with the inductively coupled plasma reactor as taught by Singh. The motivation for this modification would have been to provide the plasma process capable of generating greater ion density.

Claims 6 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Chen et al US Patent 6,155,199.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the plasma processing system being a transformer coupled plasma reactor.

Chen et al (6,155,199) discloses a transformer coupled plasma generation system which provides radio frequency plasma coupling systems that allow for

controllable, uniform inductive coupling within a plasma reactor, as well as separately controllable, uniform capacitive coupling within the reactor. (Column 2 lines 51-55)

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the general plasma processing system with the transformer coupled plasma reactor as taught by Chen et al. The motivation for this modification would have been to provide the plasma process that allow for controllable, uniform inductive coupling within a plasma reactor, as well as separately controllable, uniform capacitive coupling within the reactor.

Claims 7 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Imahashi et al US Patent 5,537,004.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the plasma processing system being an electron cyclotron resonance plasma reactor.

Imahashi et al (5,537,004) disclose an electron cyclotron resonance plasma processor wherein electron cyclotron resonance is induced under a lower magnetic field. (Column 1 line 65-67)

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the general plasma processing system with the electron cyclotron resonance plasma reactor as taught by Imahashi et al. The motivation for this

modification would have been to provide the plasma process that allow for electron cyclotron resonance to induced under a lower magnetic field.

Claims 8 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Keller et al US Patent 5,767,628.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the plasma processing system being a Helicon plasma reactor.

Keller et al discloses a helicon plasma processing tool, which provides uniform and quiescent plasma. (Column 3 line 4-6)

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the general plasma processing system with the electron cyclotron resonance plasma reactor as taught by Imahashi et al. The motivation for this modification would have been to provide the plasma process that allow for uniform and quiescent plasma to be generated.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Mavreti et al US Patent 6,424,232.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the matching network components being configured in an L circuit topology.

Mavreti et al teaches that an impedance matching circuit is constituted by an L-type circuit.

One of ordinary skill in the art would have found it obvious to replace the general matching network of Brounley with a matching network having component configured in a L type circuit topology since examiner takes notice of the equivalence of the matching network of Brounley and the L type matching network of Mavreti et al for their use in the plasma art and the selection on any of these known equivalents to provide impedance match would be within the level of ordinary skill in the art

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Kondo et al US Patent 6,462,628.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the matching network components being configured in a T circuit topology.

Kondo et al teaches that an impedance matching circuit is constituted by, for example, a C-L-C or L-C-L, Pi type or T-type circuit.

One of ordinary skill in the art would have found it obvious to replace the general matching network of Brounley with a matching network having component configured in

a L type circuit topology since examiner takes notice of the equivalence of the matching network of Brounley and the T type matching network of Kondo et al for their use in the plasma art and the selection on any of these known equivalents to provide impedance match would be within the level of ordinary skill in the art

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Ball et al US Patent 5,315,611.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception of the magnetic core being made of NiZn ferrite.

Ball et al disclose an inductor formed from a plurality of first toroidal magnetic cores fabricated of NiZn ferrite.

One of ordinary skill in the art would have found it obvious to replace the general magnetic core of Thornton et al with a magnetic core made of NiZn ferrite as taught by Ball et al since examiner takes notice of the equivalence of the magnetic core of Thornton et al and the NiZn magnetic core of Ball et al for their use in the inductor are and the selection on any of these known equivalents to provide magnetic core would be within the level of ordinary skill in the art.

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Williams et al US Patent 5,889,252.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception the matching network further comprising an additional inductive element.

Williams et al disclose in figure 3, an impedance matching network comprising of two variable inductors, which provides precise and fast matching of the load.

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the matching network of Brounley with the matching network as taught by Williams et al. The motivation for this modification would have been to provide a matching network that provides precise and fast matching to the load.

Claims 33 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Hong US Patent 6,695,954.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception a filter located between an RF source and the matching network.

Hong disclose in figure 2 a filter 32 located between the RF source 30 and the matching network 30. The filter comprises of the inductor and capacitor. The filter can eliminate or reduce substantially RF current flowing to the DC source 30.

One of ordinary skill in the art at the time of the invention would have found to obvious a filter between the RF generator and matching network of Brounley. The

motivation for this modification would have been to provide a means of eliminating or reducing substantially RF current flowing to the source.

Claims 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brounley US Patent 5,473,291 in view of Thornton et al US Patent 4,441, 092 in further view of Shamouilian et al US Patent 6,095,084.

See above rejection of claim 1, for discussion of Brounley and Thornton references.

Brounley and Thornton are shown to teach limitation of the claim with the exception a filter located between the plasma load and the matching network.

Shamouilian et al disclose in figure 4 a filter 32 located between the plasma load 55 and the matching network 235. The harmonic filter 270 are selected to adjust the phase and the amplitude of the harmonics generated in the plasma sheath to those harmonics required to produce a "normal" half-wave rectified sinusoidal sheath voltage waveform without significantly affecting the impedance match at the fundamental frequency provided by the impedance matching network 235. (Column 16 line 29-35)

One of ordinary skill in the art at the time of the invention would have found to obvious a filter between the plasma load and matching network of Brounley. The motivation for this modification would have been to provide a means of adjusting the phase and the amplitude of the harmonics generated in the plasma sheath to those harmonics required to produce a "normal" half-wave rectified sinusoidal sheath voltage waveform without significantly affecting the impedance match at the fundamental frequency provided by the impedance matching network 235.

Claim 45-58, 61, 62, 66, 67, 68, 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al US Patent 5,392,018 in view of Van Gogh et al US Patent 6,579,426.

Collins et al disclosed an impedance matching circuit used in plasma process system. The impedance matching circuit, shown in figure 3, comprises of a two variable inductance (74 78), a fixed inductance 70 and two fixed capacitors (72 76). The matching circuit has Pi circuit topology.

Thus Collins et al is shown to teach all the limitations of the claims with the exception of the variable inductance including a magnetic core, a helical coil, and an actuator for physically translating the magnetic core through the helical coil and a housing including a the variable inductance wherein the housing includes a partition that shields variable inductance. Inherently, the inductor and capacitor components of the impedance matching network will act as a filter.

Van Gogh et al discloses in figure 2, two tunable inductors (318 320) each inductor comprises of a core 318c and 320c, a coils 318a and 320a, metal housing which shield the inductor from each. A motor 352 actuate the core pieces 318c and 320c.

One of ordinary skill in the art at the time of the invention would have found to obvious to replace the variable inductors of Collins et al with the variable inductor as taught by Van Gogh et al. The motivation for this modification would have been to provide variable inductor, which improves the uniformity of the sputter deposition.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the matching network configured to deliver maximum radio frequency power of 500W, 1500W, 2500W, 3500W, 4500W and 5000W since it has been held that the discovering the optimum values of a result effective variable involves only routine skill in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the magnetic core of the variable inductors have a Curie temperature greater than 150 C, 200 C, 250 C, 300 C, 350 C, 400 C since the magnetic core material having a greater magnetic permeability has a lower Curie temperature, therefore it has been held that the discovering the optimum values of a result effective variable involves only routine skill in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the temperature factor of permeability to be within the range of $-1 X10^{-6}$ to $40 X 10^{-6}$ since it has been held that the discovering the optimum range involves only routine skill in the art.

Claim 63 is rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al US Patent 5,392,018 in view of Van Gogh et al US Patent 6,579,426 in further view of Hong US Patent 6,695,954.

See above rejection of claim 45 for discussion of Collins et al and van Gogh et al references.

Collins et al and Van Gogh et al are shown to teach limitation of the claim with the exception a filter located between an RF source and the matching network.

Hong disclose in figure 2 a filter 32 located between the RF source 30 and the matching network 30. The filter comprises of the inductor and capacitor. The filter can eliminate or reduce substantially RF current flowing to the DC source 30.

One of ordinary skill in the art at the time of the invention would have found to obvious a filter between the RF generator and matching network of Collins et al. The motivation for this modification would have been to provide a means of eliminating or reducing substantially RF current flowing to the source.

Claims 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al US Patent 5,392,018 in view of Van Gogh et al US Patent 6,579,426 in further view of Shamouilian et al US Patent 6,095,084.

See above rejection of claim 45, for discussion of Collins et al and van Gogh et al references.

Collins et al and Van Gogh et al are shown to teach limitation of the claim with the exception a filter located between the plasma load and the matching network.

Shamouilian et al disclose in figure 4 a filter 32 located between the plasma load 55 and the matching network 235. The harmonic filter 270 are selected to adjust the phase and the amplitude of the harmonics generated in the plasma sheath to those harmonics required to produce a "normal" half-wave rectified sinusoidal sheath voltage waveform without significantly affecting the impedance match at the fundamental frequency provided by the impedance matching network 235. (Column 16 line 29-35)

One of ordinary skill in the art at the time of the invention would have found to obvious a filter between the plasma load and matching network of Collins et al. The motivation for this modification would have been to provide a means of adjusting the phase and the amplitude of the harmonics generated in the plasma sheath to those harmonics required to produce a "normal" half-wave rectified sinusoidal sheath voltage waveform without significantly affecting the impedance match at the fundamental frequency provided by the impedance matching network 235.

Claim 65 is rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al US Patent 5,392,018 in view of Van Gogh et al US Patent 6,579,426 in further view of Ball et al US Patent 5,315,611.

See above rejection of claim 45, for discussion of Collins et al and van Gogh et al references.

Collins et al and Van Gogh et al are shown to teach limitation of the claim with the exception of the magnetic core being made of NiZn ferrite.

Ball et al disclose an inductor formed from a plurality of first toroidal magnetic cores fabricated of NiZn ferrite.

One of ordinary skill in the art would have found it obvious to replace the general magnetic core of Van Gogh et al with a magnetic core made of NiZn ferrite as taught by Ball et al since examiner takes notice of the equivalence of the magnetic core of Van Gogh et al and the NiZn magnetic core of Ball et al for their use in the inductor are and the selection on any of these known equivalents to provide magnetic core would be within the level of ordinary skill in the art.

Allowable Subject Matter

Claims 29, 42, 44, 59,60, 69 and 70 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimberly E. Glenn whose telephone number is (571)-272-1761. The examiner can normally be reached on Monday-Friday 7:30 to 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Pascal can be reached on (571)-272-1769. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kimberly E Glenn
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